

**ORDER**

U.S. DEPARTMENT OF TRANSPORTATION  
FEDERAL AVIATION ADMINISTRATION

**8200.40A**

**01/15/01**

**SUBJ: Flight Inspection of the Transponder Landing System (TLS)**

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- 1. PURPOSE.** This order details the flight inspection procedures, requirements, and analysis for the evaluation of the Transponder Landing System (TLS).
- 2. DISTRIBUTION.** This order is distributed to the NAVAIDS Platform Division of the National Airspace System Implementation Program, to the Airways Support Facilities Division of NAS Transition and Integration, to the National Operations and NAS Policy Divisions of NAS Operations, to the National Airway Systems Engineering Division of Operational Support, to the Program Director of Spectrum Policy and Management, to the Director and IPT Lead for Aircraft, Avionics, & Navigation Systems of the Office of Communications, Navigation, and Surveillance Systems, to the Program Director of the Air Traffic Operations Program, and to the Flight Standards Flight Technologies and Procedures Division, Washington headquarters; to the Navigation Branch of the CNS Engineering and Test Division of the William J. Hughes Technical Center; to Regional Airway Facilities and Air Traffic Divisions; to the branch level in the Flight Inspection Operations Division in Aviation System Standards, to all Flight Inspection Field Offices; and to the FAA Academy, Mike Monroney Aeronautical Center.
- 3. CANCELLATION.** This order cancels FAA Order 8200.40, Flight Inspection of the Transponder Landing System (TLS), dated September 11, 1998.
- 4. BACKGROUND.** The TLS tracks and provides landing approach guidance to an individual aircraft returning an assigned transponder identification code. TLS guidance signals emulate Instrument Landing System (ILS) signals that would exist at the current position of the tracked aircraft. TLS performance meets Federal Aviation Administration and International Civil Aviation Organization Annex 10 requirements for a Category I precision approach. TLS facilities and procedures are privately owned special use, administered under the Code of Federal Regulations (CFR) 14, Part 171, Non-Federal Navigation Facilities.
- 5. RELATED MATERIAL.**
  - a. FAA Order 8200.1A, "United States Standard Flight Inspection Manual (USSFIM)."
  - b. FAA Order 8240.36, "Instructions for Flight Inspection Reporting".
  - c. FAA Order 6700.20, "Non-Federal Navigational Aids and Air Traffic Facilities".
- 6. FLIGHT INSPECTION PROCEDURES, ANALYSIS AND TOLERANCES.** Appendix 1 contains background material concerning the TLS system. Appendix 2 contains the flight inspection procedure, requirements, and analysis for TLS approaches. Appendix 3 contains definitions for flight inspection zones and points and service volumes applicable to TLS approaches.

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Initiated By: AVN-230

**7. INFORMATION UPDATE.** Any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this order should be noted on FAA Form 1320-19, Directive Feedback Information. If an interpretation is needed, call the originating office for guidance. FAA Form 1320-19 should be used as a follow-up to the verbal conversation.

/s/

Thomas C. Accardi  
Program Director of Aviation  
System Standards

## **APPENDIX 1. BACKGROUND MATERIAL FOR THE TRANSPONDER LANDING SYSTEM (TLS)**

### **1. Introduction**

The Transponder Landing System (TLS) tracks and provides landing approach guidance to an individual aircraft returning an assigned transponder identification code. TLS guidance signals emulate Instrument Landing System (ILS) signals that would exist at the current position of the tracked aircraft. TLS performance meets Federal Aviation Administration and International Civil Aviation Organization Annex 10 requirements for a Category I approach.

The TLS determines the location of the aircraft by interrogating the aircraft transponder and then measuring the transponder range, azimuth angle, and elevation angle with two sensors located adjacent to the runway. Localizer and glide slope corrections are then computed as necessary to guide the aircraft to the desired course. This guidance information is transmitted throughout the TLS service volume using Very High Frequency (VHF) localizer and Ultra High Frequency (UHF) glide slope signals modulated with 90 and 150 Hz tones. The TLS guidance signals are dynamic in that they change with time as the tracked aircraft moves. Another aircraft not being tracked that tunes into the TLS localizer and glide slope channel will receive the guidance intended for the target aircraft, not valid guidance for its position in the airspace. This potential guidance conflict is resolved by instituting air traffic control procedures to ensure proper aircraft spacing and integrity of the service volume.

### **2. Basic TLS Operation**

The operational sequence for establishing track and providing guidance to a landing aircraft is as follows. An aircraft operating under Air Traffic Control (ATC) Instrument Flight Rules (IFR) procedures intending to make an approach is assigned a transponder identification code. The TLS system is commanded by the operator at the published control station to search the tracking area for this transponder identification code. The TLS transmits an interrogation signal which, when received by any transponder in the TLS service volume, stimulates a reply. At the same time the interrogation signal is broadcast, a "start pulse" signal is sent to the two TLS sensors to begin a data collection cycle. For a period following the start pulse, the sensors store the transponder pulse returns from all aircraft in the tracking area, along with carrier signal measurements that allow angles to be computed. The TLS then searches the pulse returns for the assigned identification code. This interrogation and search cycle is repeated several times each second. Interrogator Side Lobe Suppression (SLS) is used to block replies from outside the service volume.

When the user aircraft enters the interrogation airspace and its identification code begins to show up in the data from the sensors, the TLS identifies that aircraft as the one to be tracked and starts computing its position. If the TLS identifies two or more aircraft providing replies with the selected identification code, no guidance is generated, preventing the transmission of any Hazardous or Misleading Information (HMI). Position is computed based on the Time-of-Arrival (TOA) of the code relative to the start pulse, giving range to the aircraft, and the carrier signal phase measurements, Angle-of-Arrival (AOA), from which are derived azimuth and elevation angles. Once confidence criteria on the accuracy of the tracking solution are satisfied, the TLS begins to transmit guidance corrections based on the aircraft's horizontal and vertical offset from the predefined approach path. Interrogations, position measurements, and guidance transmissions then continue cyclically several times per second. The cycle is continued until the aircraft reaches the Missed Approach Point. The TLS then removes guidance and returns to a Diagnostic Mode to perform Built-in-Test (BIT). The system will return to Standby Mode if BIT was passed to await a command to search for the next user aircraft.

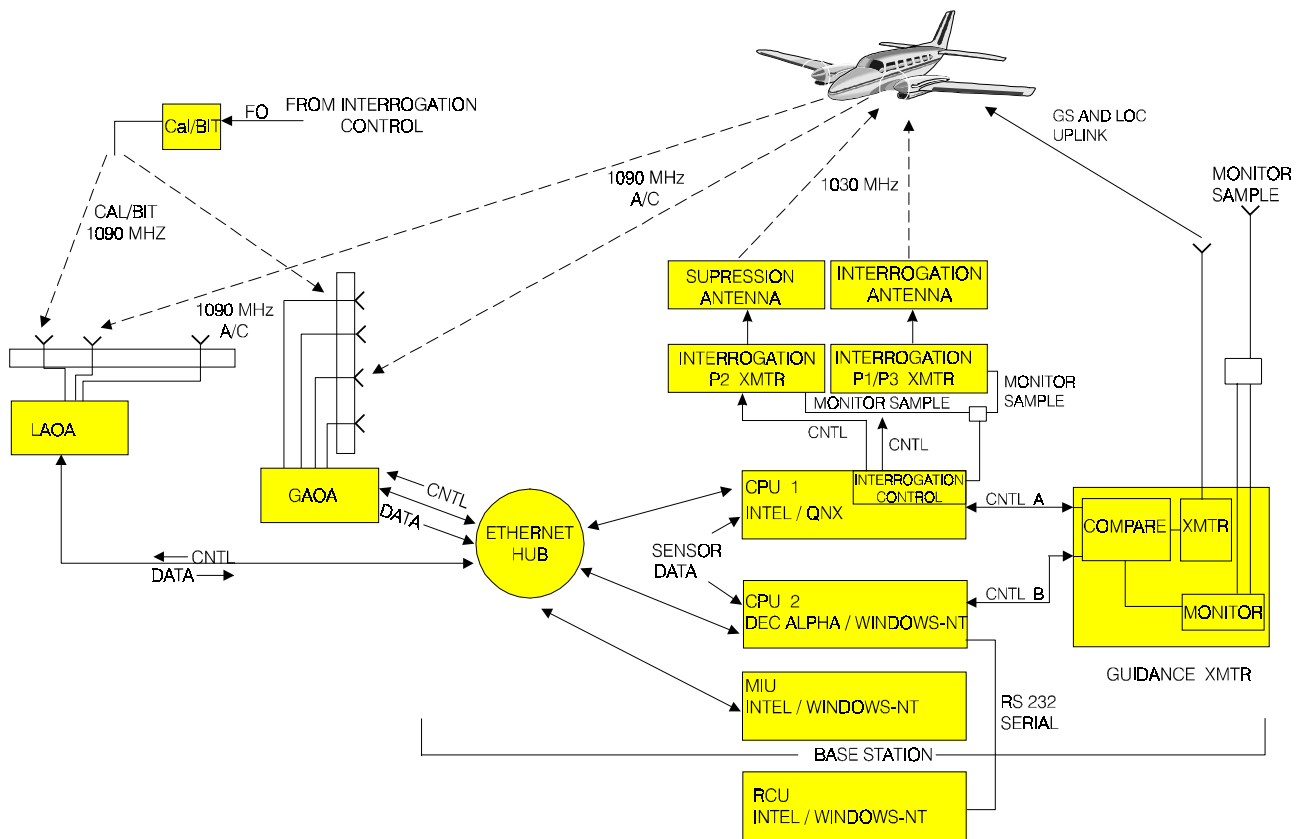
### 3. TLS Operation Sequence

- Step 1.** When the assigned aircraft enters the interrogated airspace, its transponder receives the interrogation signal.
- Step 2.** The aircraft transponder replies with its preset identification code.
- Step 3.** The aircraft reply is received by the TLS sensors.
- Step 4.** The Localizer Angle-of-Arrival (LAOA) and the Glide Slope Angle-of-Arrival (GAOA) sensors measure the time difference between the start pulse and aircraft transponder response to compute the time-of-arrival and the phase angle of the reply signal. The sensors send this data to the TLS Base Station.
- Step 5.** The Base Station computers receive the LAOA and GAOA data and calculate the location and track of the aircraft.
- Step 6.** Localizer and glide slope modulation ratios are calculated for guiding the aircraft to the desired course.
- Step 7.** These modulations are applied to the signals transmitted to the aircraft and drive the CDI display.

### 4. TLS Components. The TLS is composed of five principal components (Figure 1):

- The Localizer AOA (LAOA) and its associated antenna array
- The Glide Slope AOA (GAOA) and its associated antenna array
- The Base Station containing two Central Processing Units (BCPU), the Maintenance Interface Unit (MIU), the Interrogation Transmitter and associated antenna, and the Guidance Transmitter and associated antennas
- The Ethernet network, including fiber-optic cabling
- The Remote Control Unit (RCU)

**Figure 1**  
**TLS Block Diagram**



**APPENDIX 2. FLIGHT INSPECTION EVALUATION OF TLS**

**1. Introduction.** This appendix presents flight inspection requirements for TLS approaches. It is intended to provide guidance to the manufacturer, user/sponsor, and flight inspection personnel concerning the airborne data required for commissioning and periodic system evaluations. Flight inspection techniques and procedures are accomplished the same as for ILS, except as noted in this order.

**2. Preflight Requirements.**

**a. Facilities Maintenance Personnel.** Prepare for flight inspection in accordance with Order 8200.1A, Section 106, and pertinent sections of the TLS Maintenance Manual.

**b. Flight Personnel.** Prepare for flight inspection in accordance with Order 8200.1A, Section 106.

**c. Special Equipment Requirements:** AFIS equipped aircraft capable of Transponder Mode 3A/C as a minimum. Radio Telemetry Theodolite (RTT) may be used if AFIS is unavailable. Engineering personnel shall compute the theodolite location, due to the complexity of the position determination.

**d. Facility Data Requirements.** Engineering personnel shall supply data, in accordance with FAA Order 8240.36, Instructions for Flight Inspection Reporting, for each runway served. Particularly important are the locations of the apparent Localizer and Glide Slope antennas.

**3. Flight Inspection Procedures.**

**3.1 Checklist.** The checklist outlines the minimum evaluations required to satisfactorily perform the type of check indicated. Maintenance may request checks for facility optimization not required by the checklist or referenced in the text. Coordinate the requirement and results expected with maintenance prior to accomplishing the check.

If more than one angle is to be commissioned, inspect all checklist items at the lowest published angle. For Commissioning, check glide slope width, angle, structure, mean width and localizer alignment and structure at all higher published angles. For Periodic, check glide slope width, angle, structure, and localizer alignment and structure at all published angles.

**NOTE:** Interrogator Optimization must be accomplished prior to other commissioning checklist items.

**a. Localizer**

Type Check	Ref. Para.	Inspection		Facility Config.	MOD	WIDTH	SYM	CLR	ALIGN	STRUC
		C	P							
Interrogator Optimization	3.2.1	X								
Ident & Voice	3.2.2	X	X	Normal						X
Coverage	3.2.2	X		Reduced Guidance Power				X		X
Modulation Level	3.2.2	X	X	Normal	X					
Width	3.2.3	X	X	Normal		X	X	X		
Clearance at Lowest LCA	3.2.3	X	X	Normal		X	X	X		
High Angle Clearance	3.2.3	X		Normal				X		
Alignment	3.2.4	X	X	Normal	X				X	
Structure	3.2.4	X	X	Normal	X					X
Polarization	3.2.4	X	X	Normal						X
SIAP	3.2.9	X	X	Normal						

**b. Glide Slope**

Type Check	Ref. Para.	Inspection		Facility Config.	MOD	WIDTH	ANGLE	SYM	BELOW PATH STRUC	CLR	STRUC
		C	P								
Modulation Level	3.2.4	X	X	Normal	X						
Width	3.2.5	X	X	Normal		X		X	X		
Mean Width	3.2.6	X		Normal		X		X			
Angle	3.2.4	X	X	Normal			X				
Structure	3.2.4	X	X	Normal	X						X
Clearance	3.2.7	X	X	Normal						X	
Off-course Clearance	3.2.7	X		Normal	X					X	
Coverage	3.2.8	X		Reduced Guidance Power						X	

**3.1.1 Periodic Inspection Interval.** Periodic flight inspections shall be accomplished in accordance with FAA Order 8200.1A, Section 105. The interval shall be the same as an ILS. The first inspection following commissioning will occur in 90 days, the second 180 days from the first, and, finally, at 270 day intervals.

**3.1.2 Maintenance Procedures Requiring a Confirming Flight Evaluation.** A special flight inspection shall be required after replacement of any of the following TLS components:

- Calibration/Built-In-Test (Cal/BIT) generator or antenna
- Angle-of-Arrival (AOA) sensor, antenna cable, or antenna
- Interrogation transmitter
- Any software changes that affect aircraft signals as defined in the Technical Instruction Manual, Section 7.

**3.1.3 Zones and Points.** Flight inspection of the TLS shall be based on the zones and points described by the diagram and definitions in Appendix 3.

**3.2 FLIGHT INSPECTION PROCEDURES.** As the TLS does not transmit guidance until placed in the "ACQUIRE" mode and a suitable track on the desired aircraft is established, the flight inspection crew must anticipate a 5 to 10-second delay between requesting "ACQUISITION" and receiving a signal. Additional lead time should be planned for each run. At the end of data gathering on each run, the technician should notify the TLS station to abort the run; this stops the ground system from recording needless data to computer file. At the end of some runs, depending on whether or not the aircraft is inside the service volume, the aircraft may receive a loss of guidance signal, followed by a 5-second test signal. This is a function of the Built-in-Test (BIT) and should not be considered as a malfunction. If entering an area of adequate signal coverage from an area without line-of-sight coverage, the system delay in "acquiring" the transponder and transmitting guidance signals may falsely indicate inadequate coverage. This would most likely occur on course crossing arcs. If this situation occurs, recheck coverage in the suspect area by a run originating in an area of good signal and ensure that the system has acquired the aircraft prior to commencing the run. Flight inspection runs should not be "EXECUTED" until after signal reception to avoid erroneous structure results.

a. **During Commissioning or other checks when maintenance is present**, the equipment may be placed in abnormal configurations to facilitate maintenance data recording during some checks. These configuration changes must be accomplished at the base station. Most checks will be done with the equipment controlled from within the base station; however, at least one run must be "ACQUIRED" via the RCU as a test of radio and data-link communications.

b. **Periodic checks** should be accomplished via the RCU interface with the TLS in its normal operating configuration.

The aircraft's transponder settings shall be in LOW POWER / LOW SENSITIVITY (ON / ON) for all checks except the Interrogator Optimization checks IAW Paragraph 3.2.1; document the transponder codes used during the flight inspection on the flight inspection report in the Remarks section.

**3.2.1. Interrogator Optimization.** The setting of interrogator power and Side Lobe Suppression (SLS) is normally accomplished using installation support aircraft. On Commissioning, flight inspection validates that the final settings are adequate to support the service volume. Flight Inspection may be asked to establish initial settings of interrogator power. The aircraft transponder "FLT INSP SELECT" switch should be "ON" (Low receiver sensitivity) and the "LOW POWER SELECT" switch should be "OFF" (Normal Power). Flight Inspection may or may not receive guidance signal, and signal may be received beyond normal service volume limits. Due to TLS acquisition times, only the data obtained after passing centerline is used. If a run is broken-off, restart in the same direction from at least 5° prior to the break-off point. All runs must be accomplished as specified below. The arcs shall not be combined. Distances are referenced to apparent localizer antenna.

a. **Setting.** If the flight inspection aircraft is used to set the interrogator power and SLS level, expect to fly the following runs at the altitudes and TLS attenuator settings specified by engineering. Multiple runs may be required to optimize the settings.

<u>RUN</u>	<u>GROUND CONFIGURATION</u>
-5 to +15° arc, 22 nm	P1/P3 "ON" Attenuator "IN" P2 "OFF"
+5 to -15° arc, 22 nm	P1/P3 "ON" Attenuator "IN" P2 "OFF"
-10 to +90° arc, 12 nm	P1/P3 and P2 "ON"
+10 to -90° arc, 12 nm	P1/P3 and P2 "ON"

b. **Validation:** Using TLS Normal mode (RCU operation), fly the following arcs with P1/P3 and P2 "ON":

-5 to +15° arc, 22 nm at LCA  
 +5 to -15° arc, 22 nm at LCA  
 -10 to +45° arc, 12 nm at LCA  
 +10 to -45° arc, 12 nm at LCA

Ground analysis of the data will be accomplished to validate successful interrogation efficiency. If efficiency requirements are not met, engineering may require a second set of these flights.

**3.2.2 Localizer Standard Service Volume (SSV) or Expanded Service Volume (ESV) Arc.** This inspection is conducted to determine that the localizer guidance meets specified tolerances throughout the service volume while operating at reduced power. Check for interference, signal strength, clearances, proper flag indication, identification, voice, and structure as follows.



### 3.2.2.1 Approved Procedure.

a. **Fly an arc across the localizer course** at 18 miles from the antenna (or ESV distance, whichever is greater), at 4,500 feet above site elevation (or ESV altitude, whichever is higher) through Sector 1.

b. **Repeat the first step**, except fly across the localizer at the Lowest Coverage Altitude (LCA).

**Proceed on course**, inbound from 18 miles (or ESV, whichever is greater), maintaining the LCA to 10 miles.

c. **Fly an arc across the localizer course** at 10 nm from the antenna, at the LCA , throughout Sectors 1 and 2.

d. **Maintain the LCA and proceed inbound** on-course until reaching  $7^0$  above the horizontal (measured from the apparent localizer) or Point C, whichever occurs last.

e. **Automatic voice or marker-like transmissions** may be generated at specific aircraft positions. Determine from Engineering the status of these features and check for their usability at the appropriate locations.

**3.2.3 Localizer Width and Clearance Check.** The purpose of this check is to establish and maintain a course sector width and ratio between half-course sectors that will provide the desired displacement sensitivity as referenced to the threshold.

a. **Width, Symmetry, and Clearance.** Fly an arc at a distance of 4 to 10 nm (10 nm preferred) across the localizer course at the LCA throughout Sectors 1 and 2. Check clearances, course sector width, and symmetry. Clearances produced by the TLS are of a SAT/ UNSAT type, the amount of which is controlled in the transmitter. Coverage factors (shading) may block the entire signal, but the amount in unshaded areas should not vary appreciably. During Commissioning checks, the results obtained in reduced power IAW Paragraph 3.2.2.1.d may be used to fulfill this requirement.

b. **High Angle Arc (Commissioning).** Fly an arc across the localizer course at 10 miles from the antenna at 4,500 feet above site elevation throughout Sectors 1 and 2. Check clearances, course sector width, and symmetry. If clearances are out of tolerance, additional checks will be made at decreasing altitudes to determine the highest altitude at which the facility may be used.

c. **Width Requirements (Tailoring).** Localizer sensitivity shall be tailored for a linear sector width of 700 ft at Point T not to exceed a course sector width of  $6^0$ .

d. **Width Exceptions.** The tailoring requirement may be waived for facilities supporting Category I or LDA operations if the optimum width cannot be achieved. However, the final width shall be established as close as possible to the optimum. The course shall be restricted as unusable inside the point where the linear width is less than 400 feet.

**3.2.4 Localizer/Glide Slope Approach (Course Alignment and Structure).** These checks measure the quality and alignment of the on-course signal. The alignment and structure checks are usually performed simultaneously; therefore, use the same procedures to check alignment and structure.

**a. Precision Approach.** All approaches will be evaluated on the designed procedural azimuth and the commissioned glidepath unless otherwise indicated. For the purpose of evaluating structure, optimizing localizer and glide slope alignment, and conducting periodic inspections, start the approach at a distance not closer than the published final approach fix point or 6 miles from the runway threshold, whichever is greater.

**b. Point in Space Use.** For TLS localizer signals oriented toward a non-descript point in space where adequate visual checkpoints are not available to validate actual course alignment, the alignment may be determined to be either Satisfactory (S) or Unsatisfactory (U). TLS glide slope signals may be evaluated using rate of descent to compute the vertical angle.

**c. Localizer Only.** For TLS approaches which support localizer-only minima, the published or proposed procedural altitudes shall be maintained in each segment, except the final segment shall be flown as follows: upon reaching the FAF inbound, descend at a rate of approximately 400 feet per mile to an altitude of 100 feet below the lowest published Minimum Descent Altitude (MDA), and maintain this altitude to Point C, which is the Missed Approach Point (MAP).

**NOTE:** See Order 8200.1A, Section 301 definition of Point C for localizer-only approaches. This check shall be performed during commissioning and on a periodic inspection any time there is a significant deterioration of localizer structure.

**d. Determine the course alignment** using the area beginning 1 mile from the threshold, to the threshold. When a restriction occurs in an area where alignment is normally analyzed, measure the alignment by manual or AFIS analyzation of the average course signal from 1 mile from the start of the restriction, to the start of the restriction.

**e. Polarization effect.** The purpose of this check is to determine the effects that vertical polarization may have on the course structure. This check may be accomplished concurrently with the course structure check. Fly inbound on-course at a distance between 12 and 6 miles from the threshold and roll the aircraft to a 20° bank left and right. Actuate the event mark at the maximum banked attitude.

**3.2.5 Glide Slope Level Run (Width, Symmetry, Structure Below Path).** These parameters may be measured from the results of one level run. Position the aircraft beyond the 190  $\mu$ A/150 Hz glide slope point on the localizer course. The altitude for the level run shall be the Glide Slope Intercept (GSI) corrected to true altitude to obtain 190  $\mu$ A outside the normal path measurement area.

**a. Width.** Path width is the width in degrees of the glidepath width sector as normally measured from 75  $\mu$ A, 0  $\mu$ A, and 75  $\mu$ A.

(1) Non-linear transitions may preclude the use of the 75  $\mu$ A points. If this occurs, determine the path width of the facility between points other than 75  $\mu$ A (maximum 90  $\mu$ A, minimum 60  $\mu$ A).

The path width shall be determined by proportioning the value obtained at the selected points to 75  $\mu$ A.

(2) If a point other than 75  $\mu$ A is used to measure path widths, that point shall be used on all subsequent checks and inspections.

**b. Symmetry.** Symmetry is the balance of the 150 Hz and 90 Hz width sectors as is determined from the data obtained during level run width measurements. If points other than the 75  $\mu$ A points are used from measuring the path width, they shall also be used for the symmetry measurements. The glidepath envelope should be as symmetrical as possible.

When a facility exceeds the specified tolerance and cannot be adjusted, AFIS shall be used to determine the mean symmetry (see FAA Order 8200.1, Section 217, Mean Width). If the mean symmetry remains out-of-tolerance, the facility shall be removed from service.

**c. Structure-Below-Path.** This check determines that the 190  $\mu$ A/150 Hz point occurs at an angle above the horizontal that is at least 30 percent of the commissioned angle. The structure below path is determined from the data obtained during the level run angle or width measurements. Altitudes lower than GSI may be required to make this measurement.

**3.2.6 Mean Width.** This check is used to determine the mean width of a glidepath between Points "A" and "B". This check may also be used to determine the mean symmetry of the glidepath.

The path width should be established, as nearly as possible, to 0.7° prior to the check. Fly an approach, maintaining 75  $\mu$ A above the glidepath between Points "A" and "B". Repeat the same run at 75  $\mu$ A below the glidepath, and again while on the glidepath. Determine the mean width from the angle found above and below the glidepath and calculate symmetry from the on-path angle. It is important that the aircraft not deviate too far beyond 75  $\mu$ A on these runs, as the TLS will sense the aircraft track as beyond the limits of normal flight and automatically abort the guidance.

**3.2.7 Clearance.** This check is performed to assure that positive fly-up indications exist between the bottom of the glidepath sector and obstructions. Glide slope clearances will not exceed approximately 195  $\mu$ A, regardless of deviation from the correct angle. Below path runs are more difficult than on standard ILS, due to the absence of proportionality beyond the maximum  $\mu$ A value. Pilot/ET coordination and situational awareness are essential during this check. Clearances above the path are checked to ensure that positive fly-down indication is received prior to receiving the flag alarm.

**a. Clearance Below the Path.** Fly along the localizer on-course (or the areas specified by the checklist). Check that the required amount of fly-up signal provides adequate obstacle clearance between the FAF or GSI, whichever is further, and:

(1) ILS point "C" for an unrestricted glide slope; or, the point at which the glide slope is restricted,

(2) Clearance Above the Path. Check that 150  $\mu$ A fly-down occurs prior to receiving the flag alarm. Perform this check during the level runs.

**b. Off Course Clearances.** On commissioning, measure the below path clearances at each extremity of the localizer course sector from GSI to Point B.

**3.2.8 Glide Slope SSV.** The glidepath transmitter shall be placed in reduced power setting for this check. This check shall be made on the localizer on-course and 8° on each side of the localizer on-course. For localizer service aligned on or within 3° of runway centerline, the vertex of this 8° angle shall be abeam the glide slope origination point; for LDA service beyond 3.0°, it shall be the point abeam the actual runway threshold. For level run, while maintaining the LCA, fly inbound from 10 miles from the facility, or ESV (whichever is further), to the interception of the lower sector of the glidepath (i.e., the point nearest the glidepath at which 150  $\mu$ A occurs). Fly through the glidepath sector; check fly-up clearances below, and fly down clearances above the path.

**3.2.9 Standard Instrument Approach Procedure (SIAP).** The approach procedure shall be evaluated IAW Order 8200.1A, Section 214.

**4. Flight Inspection Analysis.** Data analysis shall be in accordance with FAA Order 8200.1A, Section 217.

**4.1 Application of Localizer/Course/Glidepath Structure Tolerances.** Application of course structure analysis contained in this paragraph applies to all zones (1, 2, 3) of glidepaths and all zones of localizers (1, 2 & 3). If course or path tolerances are exceeded, analyze the course/path structure as follows:

**a. Where course/path structure is out-of-tolerance** in any region of the approach, the flight recordings will be analyzed in distance intervals of 7,089 feet (1.17 nm) centered about the region where the out-of-tolerance or aggregate of out-of-tolerance condition(s) occurs. Two 7,089 foot areas shall not overlap.

**b. Where necessary to avoid overlap**, centering the interval about the out-of-tolerance region may be disregarded.

**c. It is not permissible** to extend the 7,089 foot segment beyond the area checked, i.e., service volume or ESV, whichever is greater, or the point closest to the runway where analyzation stops.

**d. The course/path structure** is acceptable if the aggregate structure is out-of-tolerance for a distance equal to or less than 354 feet within each 7,089 foot segment.

**4.1.1 Rate of Change/Reversal in the Slope of the Glidepath.** The following analysis of the path angle recording shall be accomplished during all inspections where AFIS, RTT, or other tracking devices are being used. It applies to all categories of ILS.

**a. Inspect the glidepath** corrected error trace/differential trace in Zones 2 and 3 for changes and or reversals in the trend of the slope of the path trace.

**b. Determine if the trace** (or trend), on either or both sides of the point where a change in direction occurs, extends for at least 1,500 ft along the approach with an essentially continuous slope.

**c. If one or more changes/reversals** meets the condition in b. above, draw a straight line through the average slope that covers at least a 1,500 ft segment each side of the point of change. It is permissible to extend the straight line of the average slope to inside Point C if required, in order to obtain the 1,500 ft segment. Determine the change-in-slope by measuring the divergence of the two lines at a point 1,000 ft from their intersection.

**d. NOTAM Action.** Facilities which do not meet the tolerance shall not be classified as restricted, but shall have an autopilot use limitation imposed by NOTAM. Autopilot coupled approaches are not authorized below an altitude (MSL) that is 50 ft higher on the glidepath than the altitude at which the out-of-tolerance change in slope occurs. Compute the MSL altitude of such a limitation based on the commissioned angle of the facility. Advise the appropriate procedures specialist. Specific NOTAM instructions are in Order 8200.1A, Paragraph 107.34.

**4.2 Application of Localizer Coverage Requirements.** The maneuvering areas described in the approved procedures of this section define the standard service volume in which coverage tolerances shall be maintained for a localizer to be assigned a facility classification of "UNRESTRICTED". The localizer may still be usable when coverage does not meet tolerances throughout the standard service volume, depending on the effect of the restriction on procedural use. The TLS will often be installed in those sites unsuitable for standard ILS.

While it will work in more adverse terrain, it can be expected to suffer from terrain factors, including signal screening. Any line-of-sight screening would most likely degrade the interrogator and/or transponder signal and as a consequence, no guidance signal will be available in the screened area. In evaluating such effects, all coverage criteria must be considered; however, for an UNRESTRICTED classification, the following criteria must also be met:

**a. Clearances**

(1) Restrictions. If a localizer is restricted in Sector 2, it shall not be used for a procedure turn on the restricted side, unless the inbound procedure turn course guidance is provided by some other facility, such as a VOR, NDB, etc.

(2) Momentary deviations of the localizer cross pointer in Sector 1 can be averaged without further evaluation, provided the cross pointer deviation does not present a noticeable effect on flyability or create a possible false course. Questionable reversals of trend or

excessive irregular flattening of the course ("steps") require an evaluation of the effect on the procedure. When this condition occurs, re-fly the Sector 1 arc at the service volume limit at LCA at a maximum ground speed of 170 knots. Evaluate for noticeable effects on flyability and possible false course indications. The procedure shall be removed if reversals of trend exceed 10  $\mu$ A or flyable false course indications occur. If the arc at LCA is satisfactory for flyability, document the check on the facility data sheet, e.g., "Deviations in Sector 1 clearance linearity evaluated and the results found satisfactory IAW 8200.40A, Appendix 2, Paragraph 4.2a.

**b. Distance Requirements.**

(1) Restrictions to localizer coverage at distances less than the standard service volume are permitted, provided the localizer meets all coverage tolerances throughout all procedural approach segments and at the maximum distance at which the procedure turn may be completed.

(2) Restrictions above the LCA are acceptable, provided a step-down fix, etc., can be added to the appropriate approach segment which restricts descent to within the altitude/distance at which acceptable coverage at the LCA was achieved.

**c. Vertical Angle Requirements.**

(1) If in-tolerance coverage cannot be maintained up to 7° or point C as required by step e in the coverage check, the localizer may still be used for CAT I and non-precision operations on a restricted basis; however, the localizer shall be classified as "unusable" if in-tolerance coverage cannot be maintained up to 4° or 1° greater than the commissioned glidepath angle, whichever is greater (both measured from the localizer).

(2) If vertical angle coverage is limited but the localizer can be used on a restricted basis as outlined above, a NOTAM shall be issued which restricts the localizer as "unusable" above a specified altitude, both at the threshold and at least one other point, usually the FAF. Note the angle at which unsatisfactory coverage occurred and evaluate its effect on the non-precision MDA, maximum holding altitudes, and missed approach instructions/ protected areas.

**4.3 Application of Glide Slope Coverage Requirements.** Although there is no specified tolerance, the approved procedure specifies to check for clearances above the path. If there is no defined glidepath or clearance above path, the glide slope shall be restricted as unusable beyond the point at which no glidepath or clearance above path is provided.

## 5. Tolerances.

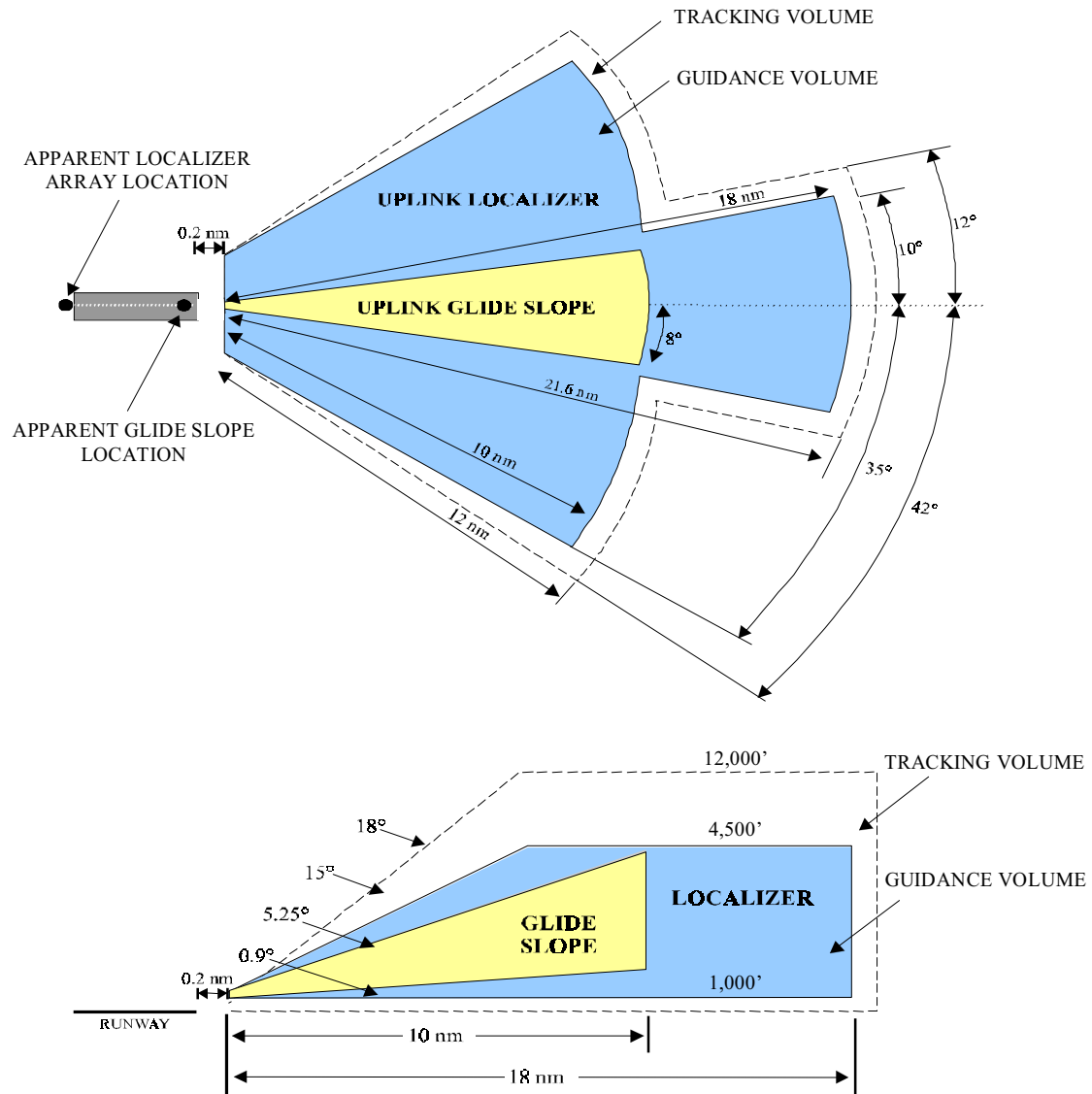
## a. Localizer

Parameter	Reference	Inspection		Tolerance/Limit
		C	P	
Modulation Level	3.2.2	X	X	36 – 44%
Width	3.2.3			Maximum -- 6.0° Precision approach -- 400 feet minimum course width at the threshold
		X		± 0.1° of the commissioned width
			X	Within 17% of the commissioned width.
Symmetry	3.2.3	X	X	45 - 55%
Alignment	3.2.4	X		Within 3 $\mu$ A of the designed procedural azimuth
			X	From the designed procedural azimuth: ± 15 $\mu$ A for CAT I ± 20 $\mu$ A for offset localizer/LDA
Structure	3.2.4	X	X	Zone 1 -- from the graphical average course: ± 30 $\mu$ A to Point A
				Zone 2 -- from the actual course alignment ± 30 $\mu$ A at Point A; linear decrease to ± 15 $\mu$ A at Point B.
				Zone 3 -- from the actual course alignment ± 15 $\mu$ A at Point B; ± 15 $\mu$ A at Point C.
				Exception: An aggregate out-of-tolerance condition for 354 feet may be acceptable in a 7,089-foot segment.
				NOTE: For offset localizer and LDA installations, measure structure from graphical average course.
Polarization	3.2.4	X	X	Polarization error not greater than ± 15 $\mu$ a
Coverage	3.2.2	X	X	Signal Strength -- ≥ 5 $\mu$ V Flag Alarm – No Flag
				Clearance and Structure -- in tolerance Interference -- shall not cause an out-of-tolerance condition.
Clearances	3.2.3	X	X	Sector 1 -- linear increase to 175 $\mu$ A then maintain 175 $\mu$ A to 10°
				Sector 2 -- 150 $\mu$ A
Identification and Voice	3.2.2	X	X	Clear, correct; audio level of the voice equal to the identification level. The identification shall have no effect on the course. Voice shall not cause more than 5 $\mu$ A of course disturbance.

**b. Glide Slope**

Parameter	Reference	Inspection		Tolerance/Limit
		C	P	
Modulation Level	3.2.5	X		78 - 82%
			X	75 - 85%
Width	3.2.5	X		$0.7^{\circ} \pm 0.05^{\circ}$
			X	$0.7^{\circ} \pm 0.2^{\circ}$
Angle	3.2.4	X		$\pm 0.05^{\circ}$ of the commissioned angle
			X	+10.0% to -7.5% of the commissioned angle
Symmetry	3.2.5	X	X	67 - 33%
Structure below Path	3.2.5	X	X	190 $\mu$ A of fly-up signal occurs at an angle which is at least 30% of the commissioned angle.
		X	X	Exception: If this tolerance cannot be met, apply clearance procedures and tolerances.
Clearance	3.2.7	X	X	Below Path: Adequate obstacle clearance at 180 $\mu$ A or greater of fly-up signal Above Path: 150 $\mu$ A of fly-down signal
Structure	3.2.4	X	X	Zone 1 -- 30 $\mu$ A from graphical average path Zone 2 -- 30 $\mu$ A from actual path angle Zone 3 -- 30 $\mu$ A from graphical average path Exception: An aggregate out-of-tolerance condition for 354 feet may be acceptable in a 7,089-foot segment.
Change/Reversal	4.11	X	X	25 $\mu$ A per 1,000 ft in a 1,500 ft segment
Coverage	3.2.8	X	X	Signal Level -- $\geq 15 \mu$ V Flag Alarm -- No Flag Fly-up Signal -- $\geq 150 \mu$ A Fly-down Signal -- $\geq 150 \mu$ A Clearance and Structure -- in-tolerance Interference -- shall not cause an out-of-tolerance condition.

**6. Records, Reports, and Notices to Airman.** See Sections 107 and 108 of FAA Order 8200.1A, USSFIM and FAA Order 8240.36 for ILS reports.

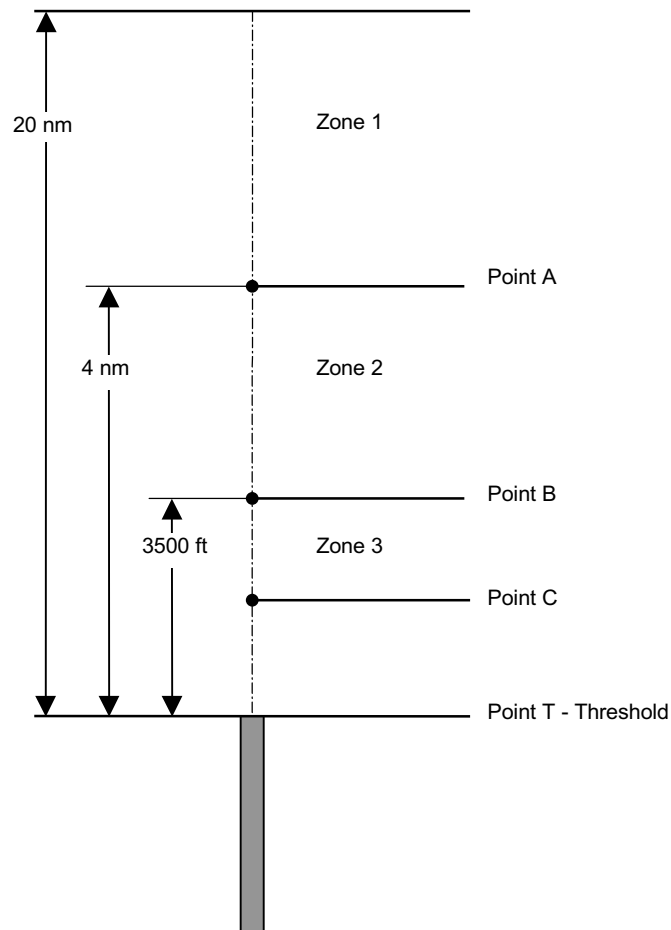
**APPENDIX 3. TLS ZONES, POINTS AND COVERAGE****Figure 1  
Standard TLS Service Volume****TLS Sector Definitions:**

**TLS Localizer Coverage Sector 1.** From  $0^0$  to  $10^0$  each side of the center of the localizer on-course.

**TLS Localizer Coverage Sector 2.** From  $10^0$  to  $35^0$  each side of the center of the localizer on-course.



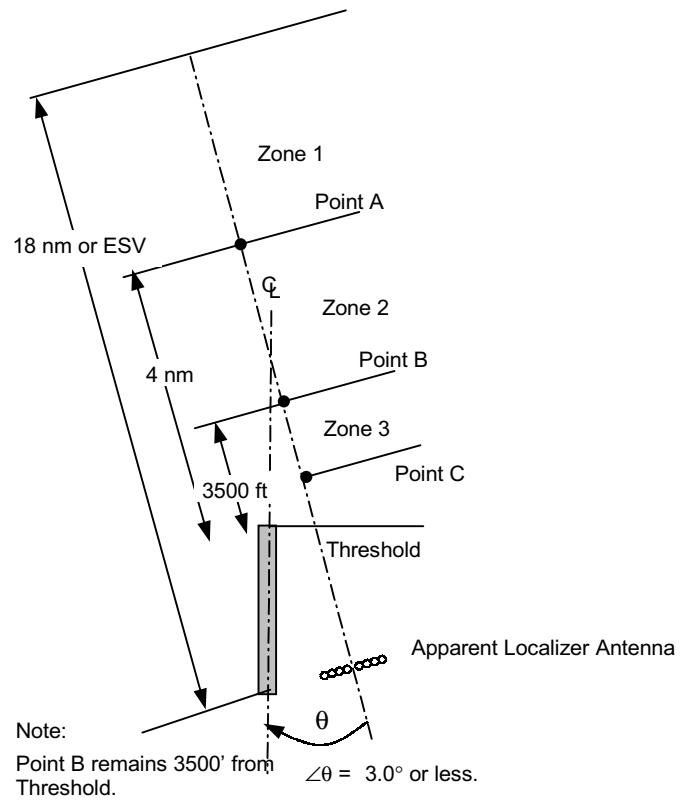
**Figure 2**  
**Definition of TLS Points And Zones**



The following definitions for flight inspection points and zones shall apply to analysis of TLS flight inspection data:

- Point A. A point on-course located 4 nautical miles from the runway threshold measured along the runway centerline extended
- Point B. A point on-course located 3500 feet from the runway threshold measured along the runway centerline extended.
- Point C. A point through which the glidepath (as commissioned) passes at a height of 100 feet above the horizontal plan containing the runway threshold. For operations without a glidepath, Point C is the MAP.
- Zone 1. The distance from the localizer/glidepath coverage limit to Point A.
- Zone 2. The distance from Point A to Point B on-course.
- Zone 3. The distance from Point B to Point C on-course

**Figure 3**  
**TYPICAL OFFSET TLS**



# TLS LDA CONFIGURATIONS

Figure 4

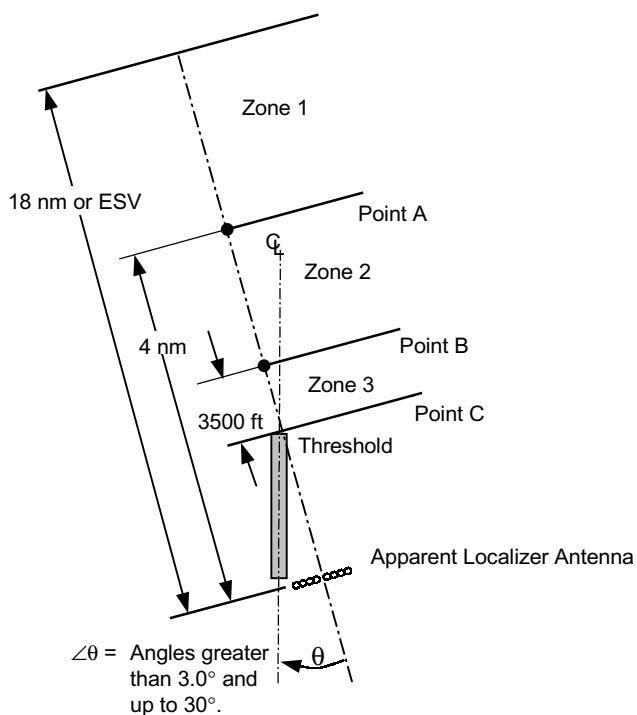


Figure 5

